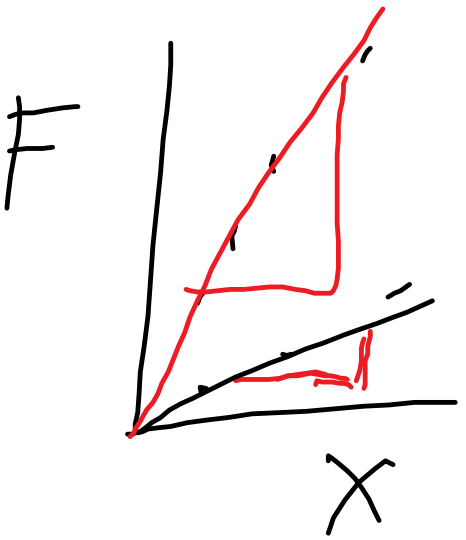
Hooke's Law

Get elastic bands and springs.
pull with a spring scale and measure the extension,
x = change in length, ΔL
graph F vs x

F(N) elastic	F(N) spring	$x=L-L_o$ (cm)
0	0	0
		2.0
		4.0
		6.0
		8.0
		10.0
		12.0



A perfectly elastic object, compresses or extends a distance, x, when experiencing a force, F, proportionally to the force and returns to its original shape without loss of energy.

$F=-kx$ k is the slope of F-x graph = F/x
negative because the force is in the opposite direction to the extension.
k is the elastic constant or spring constant, units N/m

your data didn't perfectly match, some had y-

intercept. Why?
- didn't zero the scale properly
- most objects are not perfectly elastic - internal force - overcome before it stretches - like friction
- damping - energy is lost in the stretch/compress

elastic limit – ~~material~~ elastic breaks or doesn't go back to original shape

1. You put a 500 g mass on a spring hung vertically and the length changes from 15.0cm to 19.0 cm.

a) what is the extension? 19-15=4.0 cm

b) what is the elastic constant of the spring?

k=-F/x -(0.50kgx9.81N/kg)/(-4.0cm)
k= 4.9/4=1.225 = 1.2N/cm

c) if you pulled the mass down until the spring is 21.0 cm long and let go, what is the acceleration of the mass?
d) when the spring returns to 19.0 cm of length, what is the acceleration?
e) the mass rises due to inertia until the spring is 17.0cm. What is the acceleration of the mass at that point?
f) bonus: what is the speed of the mass when the spring is 19.0 cm of length? requires work-energy theorem.

1. What is the gravitation attraction between a 50.0kg student and a 60.0 kg student 1.5 m apart? Why don't you slide over?

$F=GMm/r^2$
$=(6.67 \times 10^{-11}Nm^2/kg^2 \times 60kg \times 50kg)/(1.5m)^2$
$6.67x60x50/(1.5x1.5)=8,893.3333$
$8.9 \times 10^{-8}N$

2. If g on earth is 9.81 N/kg and the radius of the Earth is 6.38×10^6m, what is the mass of the Earth? (no cheating!)
$mg=GMm/r^2$

$g=GM/r^2$
$M=gr^2/G = (9.81N/kgx(6.38x10^6$

$m)^2/6.67x10^{-11}Nm^2/kg^2$
$9.81x6.38x6.38/6.67=59.8666$
$5.99 \times 10^{24}kg$

x 10exp
x 10 x 10